CHI MEI
OPTOELECTRONICS CORP.

Issued Date: Aug. 11, 2005
Model No.: N150P5 -L01

Approval

TFT LCD Approval Specification

MODEL NO.: N150P5   -L01

Customer :   HP

Approved by : _____

Note :

Liquid Crystal Display Division	
QRA Division.	OA Head Division.
Approval	Approval
陳 94. 8. 12 永一	Wu Chao-Wen 8/12 05 10:00

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REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver 3.0	Aug.11. '05	All	All	Issue Approval Specification for HP

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1. GENERAL DESCRIPTION

1.1 OVERVIEW

N150P5 is a 15.0" TFT Liquid Crystal Display module with single CCFL Backlight unit and 30 pins LVDS interface. This module supports 1400x 1050 SXGA+ mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is not built in.

1.2 FEATURES

- Thin and light weight

- SXGA+ (1400 x 1050 pixels) resolution

- DE (Data Enable) only mode

- 2 channel 3.3V LVDS (Low Voltage Differential Signaling) interface

- Support EDID Structure Version 1 Revision 3

1.3 APPLICATION

- TFT LCD Notebook

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Active Area	304.5 (H) x 228.375 (V) (15" diagonal)	mm	(1)
Bezel Opening Area	308.1 (H) x 232 (V)	mm	(1)
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1400 x R.G.B. x 1050	pixel	-
Pixel Pitch	0.2175 (H) x 0.2175 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hardness (3H), Anti-glare (Haze 25)	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	316.8	317.3	317.8	mm	(1)
	Vertical(V)	241.5	242.0	242.5	mm	
	Depth(D)	-	5.7	6.0	mm	
Weight		-	530	550	g	-
I/F connector mounting position		The mounting inclination of the connector makes the screen center within ±0.5mm as the horizontal.				(2)

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

(2) Connector mounting position

+/- 0.5mm

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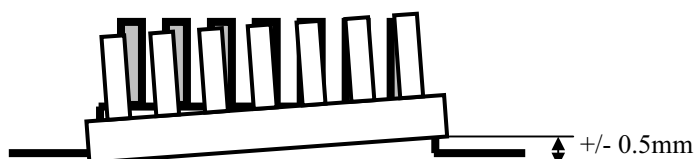
2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1), (2)
Shock (Non-Operating)	S_{NOP}	-	220/2	G/ms	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	1.5	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

    (a) 90 %RH Max. (Ta $\leqq$ 40 ºC).

    (b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

    (c) No condensation .

Relative Humidity (%RH)
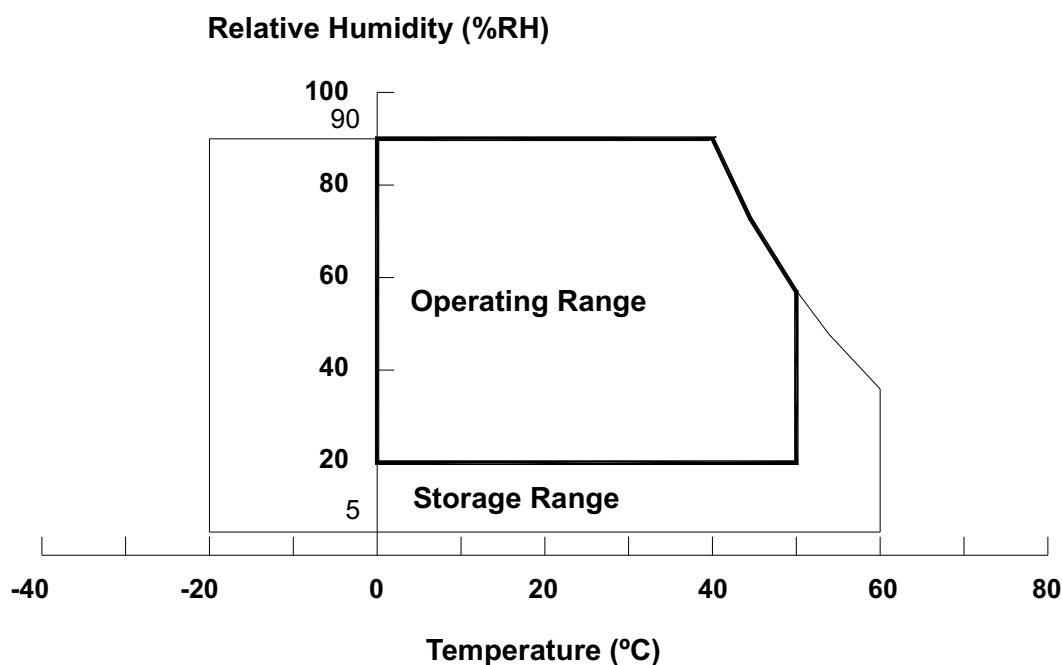
Temperature (ºC)

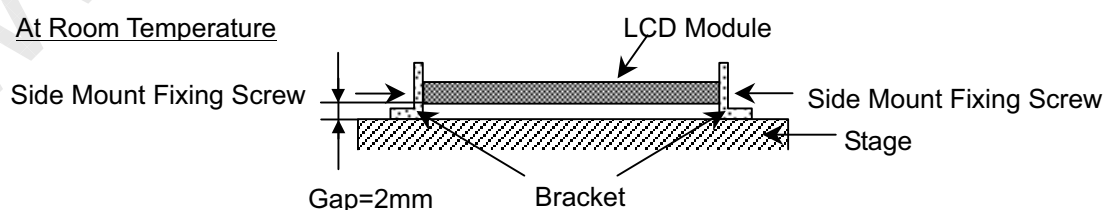Note (2) The temperature of panel surface should be 0 ºC Min. and 50 ºC Max.

Note (3) Condition for 220/2 G/ms is Half Sine Wave.

Note (4) 10 ~ 500 Hz, 0.5 Hr / Cycle, 1 cycles for each X, Y, Z. The fixing condition is shown as below:

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

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2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	-0.3	+4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	Vcc+0.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_L	-	2.5K	V_{RMS}	(1), (2), I_L = (6.0) mA
Lamp Current	I_L	-	7.0	mA_{RMS}	(1), (2)
Lamp Frequency	F_L	-	80	KHz	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation

should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to Section 3.2 for further information).

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3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta = 25 ± 2 ℃

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	-
Ripple Voltage		V_{RP}	-	50	-	mV	-
Rush Current		I_{RUSH}	-	-	1.5	A	(2)
Power Supply Current	White	Icc	-	400	450	mA	(3)a
	Black		-	530	580	mA	(3)b
Differential Input Voltage for LVDS Receiver Threshold	"H" Level	V_{IH}	-	-	+100	mV	-
	"L" Level	V_{IL}	-100	-	-	mV	-
Terminating Resistor		R_T	-	100	-	Ohm	-

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:

Vcc rising time is 470us

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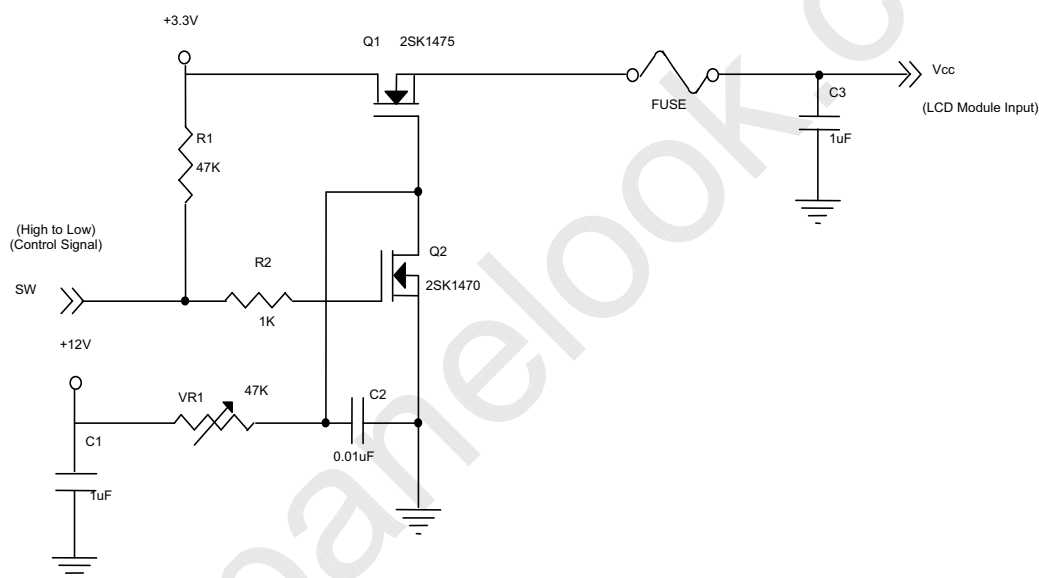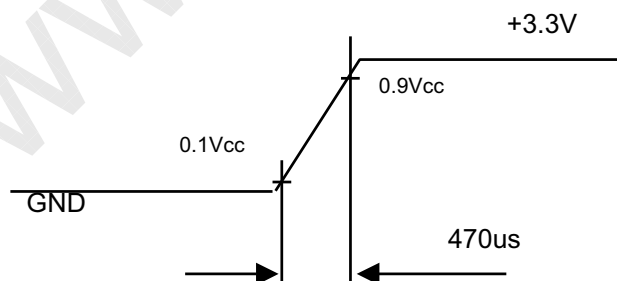
Note (3) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, DC Current and f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

Active Area

b. Black Pattern

Active Area

3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

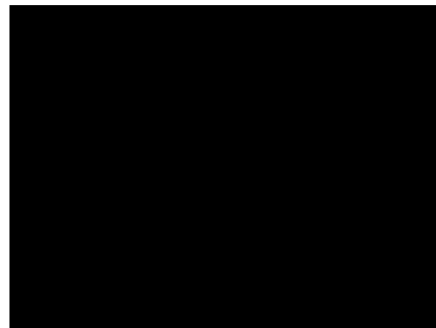| Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	641	675	709	V_{RMS}	I_L = 6.0 mA
Lamp Current	I_L	2.0	6.0	7.0	mA_{RMS}	(1)
Lamp Turn On Voltage	V_S	-	-	1150 (25 ^{o}C)	V_{RMS}	(2)
		-	-	1385 (0 ^{o}C)	V_{RMS}	(2)
Operating Frequency	F_L	45	65	80	KHz	(3)
Power Consumption	P_L	-	4.05	-	W	(4), I_L = 6.0 mA
Lamp Life Time	L_{BL}	10,000	-	-	Hrs	(5)
Leakage Current	I_{IN}-I_{OUT}	-	-	1.0	mA	(7)

Note (1) Lamp current is measured by utilizing a high frequency current meter as shown below:

LCD Module — HV (Pink) — 1 / LV (Black) — 2 — (A) Current Meter — Inverter
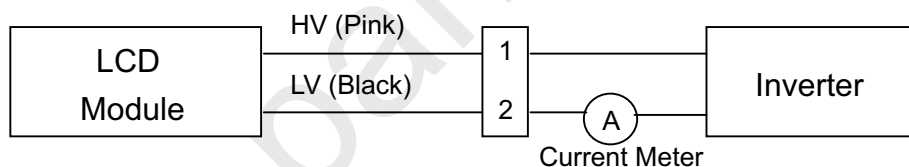
Note (2) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may generate interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) $P_L = I_L \times V_L$

Note (5) The lifetime of lamp is defined as the time when it continues to operate under the conditions at Ta = 25 ± 2 ^{o}C and I_L = 6.0 mA_{RMS} until one of the following events occurs:

(a) When the brightness becomes $\leqq$ 50% of its original value.

(b) When the effective ignition length becomes $\leqq$ 80% of its original value. (Effective ignition length is defined as an area that the brightness is less than 70% compared to the center point.)

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Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid generating too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

Note (7) The lamp leakage current is measured by the current difference between in and out. And the measurement condition is as below:

$$I_{Leak(RMS)} = I_{High(RMS)} - I_{Low(RMS)}$$

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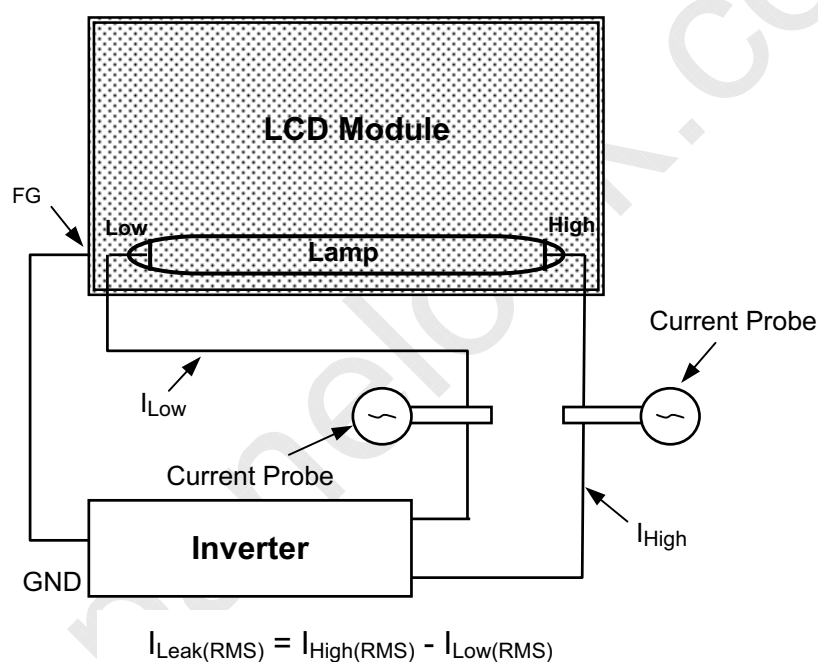
4. BLOCK DIAGRAM

4.1 TFT LCD MODULE

4.2 BACKLIGHT UNIT

1 HV (Pink)
2 LV (Black)

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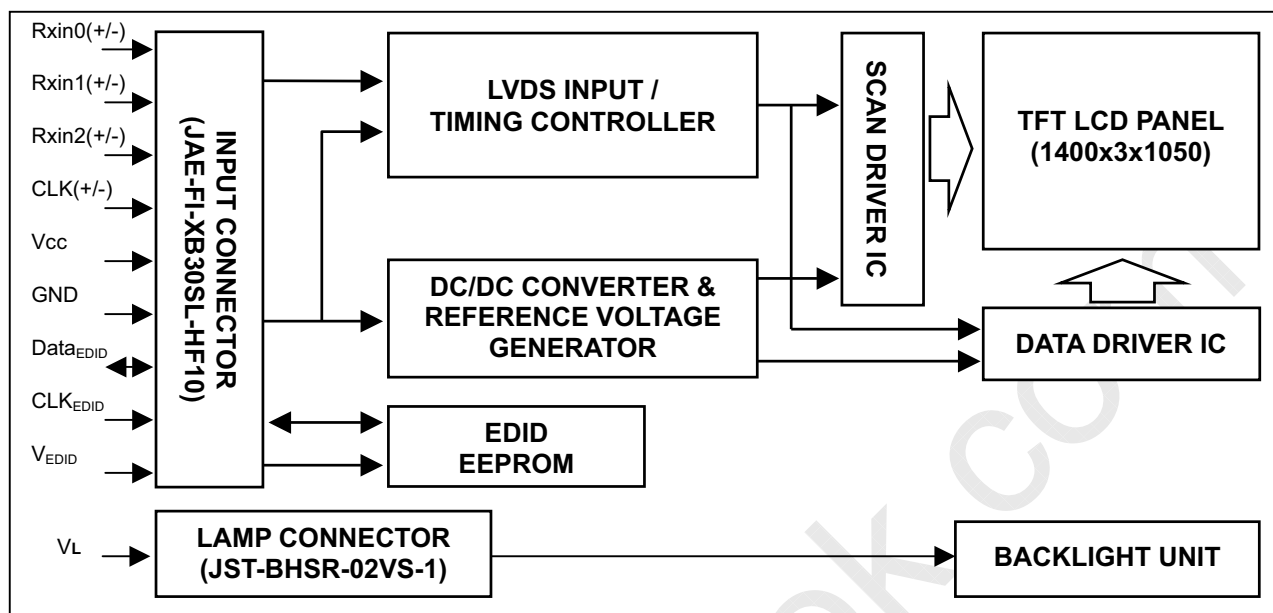
5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

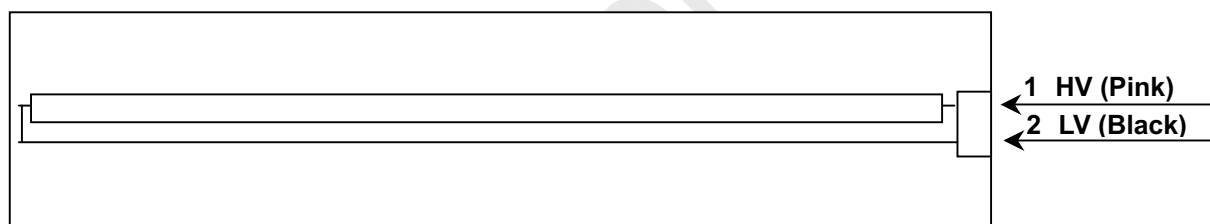| Pin	Symbol	Description	Polarity	Remark
1	Vss	Ground		-
2	Vcc	Power Supply +3.3 V		-
3	Vcc	Power Supply +3.3 V		-
4	V_{EDID}	DDC +3.3V		-
5	NC	Non-Connection		-
6	CLK_{EDID}	DDC Clock		-
7	$DATA_{EDID}$	DDC Data		-
8	RXE0-	LVDS Differential Data Input(even)	Negative	R0~R5,G0
9	RXE0+	LVDS Differential Data Input(even)	Positive	
10	Vss	Ground		-
11	RXE1-	LVDS Differential Data Input(even)	Negative	G1~G5,B0,B1
12	RXE1+	LVDS Differential Data Input(even)	Positive	
13	Vss	Ground		-
14	RXE2-	LVDS Differential Data Input(even)	Negative	B2~B5,DE,Hsync,Vsync
15	RXE2+	LVDS Differential Data Input(even)	Positive	
16	Vss	Ground		-
17	RXEC-	LVDS Clock Data Input(even)	Negative	LVDS Level
18	RXEC+	LVDS Clock Data Input(even)	Positive	
19	Vss	Ground		-
20	RXO0-	LVDS Differential Data Input(odd)	Negative	R0~R5,G0
21	RXO0+	LVDS Differential Data Input(odd)	Positive	
22	Vss	Ground		-
23	RXO1-	LVDS Differential Data Input(odd)	Negative	G1~G5,B0,B1
24	RXO1+	LVDS Differential Data Input(odd)	Positive	
25	Vss	Ground		-
26	RXO2-	LVDS Differential Data Input(odd)	Negative	B2~B5,DE,Hsync,Vsync
27	RXO2+	LVDS Differential Data Input(odd)	Positive	
28	Vss	Ground		-
29	RXOC-	LVDS Clock Data Input(odd)	Negative	LVDS Level
30	RXOC+	LVDS Clock Data Input(odd)	Positive	

Note (1) The first pixel is even.

Note (2) Connector Part No.: JAE-FI-XB30SL-HF10 or equivalent

Note (3) User's connector Part No: JAE-FI-X30C2L or equivalen

5.2 BACKLIGHT UNIT

Pin	Symbol	Description	Color
1	HV	High Voltage	Pink
2	LV	Ground	Black

Note (1) Connector Part No.: JST-BHSR-02VS-1 or equivalent

Note (2) User's connector Part No.: JST-SM02B-BHSS-1-TB or equivalent

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5.3 TIMING DIAGRAM OF LVDS INPUT SIGNAL

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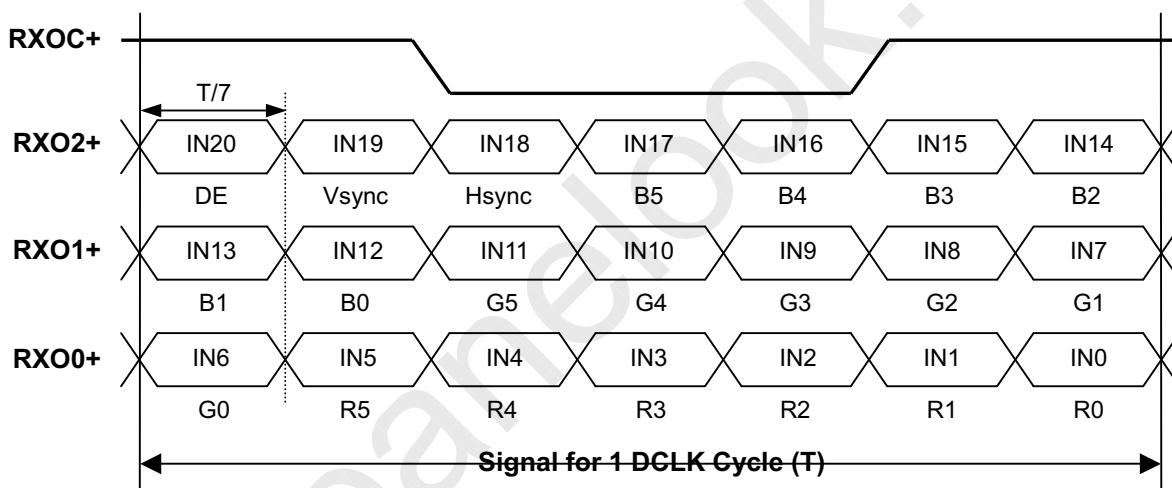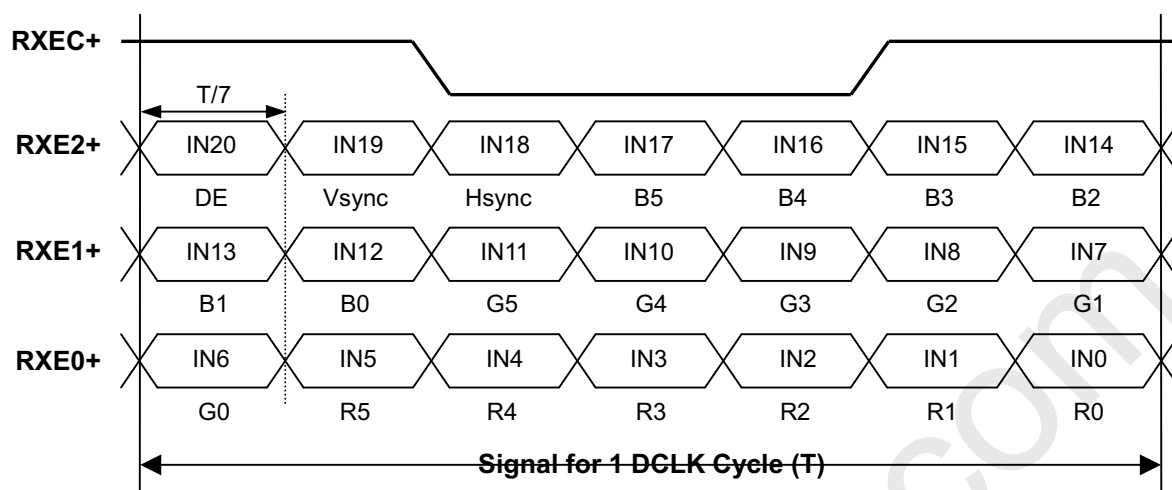
5.4 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																		
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

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5.5 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPDI standards.

Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	EISA ID manufacturer name ("CMO")	0D	00001101
9	9	EISA ID manufacturer name (Compressed ASCII)	AF	10101111
10	0A	ID product code (N150P5-L01)	08	00001000
11	0B	ID product code (hex LSB first; N150P5-L01)	15	00010101
12	0C	ID S/N (fixed "0")	00	00000000
13	0D	ID S/N (fixed "0")	00	00000000
14	0E	ID S/N (fixed "0")	00	00000000
15	0F	ID S/N (fixed "0")	00	00000000
16	10	Week of manufacture (fixed "53")	35	00110101
17	11	Year of manufacture (fixed "2004")	0E	00001110
18	12	EDID structure version # ("1")	01	00000001
19	13	EDID revision # ("3")	03	00000011
20	14	Video I/P definition ("digital")	80	10000000
21	15	Max H image size ("30.45 cm")	1E	00011110
22	16	Max V image size ("22.837 cm")	17	00011110
23	17	Display Gamma (Gamma = "2.2")	78	01111000
24	18	Feature support ("Active off, RGB Color")	0A	00001010
25	19	Red/Green (Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0)	05	00000101
26	1A	Blue/White (Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0)	60	01100000
27	1B	Red-x (Rx = 0.590)	97	10010111
28	1C	Red-y (Ry = 0.340)	57	01010111
29	1D	Green-x (Gx = 0.318)	51	01010001
30	1E	Green-y (Gy = 0.537)	89	10001001
31	1F	Blue-x (Bx = 0.150)	4C	01001100
32	20	Blue-y (By = 0.120)	1E	00011110
33	21	White-x (Wx = 0.313)	50	01010000
34	22	White-y (Wy = 0.329)	54	01010100
35	23	Established timings 1	00	00000000
36	24	Established timings 2 (1400x1050@60Hz)	08	00001000
37	25	Manufacturer's reserved timings	00	00000000
38	26	Standard timing ID # 1	01	00000001
39	27	Standard timing ID # 1	01	00000001
40	28	Standard timing ID # 2	01	00000001
41	29	Standard timing ID # 2	01	00000001

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Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
42	2A	Standard timing ID # 3	01	00000001
43	2B	Standard timing ID # 3	01	00000001
44	2C	Standard timing ID # 4	01	00000001
45	2D	Standard timing ID # 4	01	00000001
46	2E	Standard timing ID # 5	01	00000001
47	2F	Standard timing ID # 5	01	00000001
48	30	Standard timing ID # 6	01	00000001
49	31	Standard timing ID # 6	01	00000001
50	32	Standard timing ID # 7	01	00000001
51	33	Standard timing ID # 7	01	00000001
52	34	Standard timing ID # 8	01	00000001
53	35	Standard timing ID # 8	01	00000001
54	36	Detailed timing description # 1 Pixel clock ("108 MHz")	30	00110000
55	37	# 1 Pixel clock (hex LSB first)	2A	00101010
56	38	# 1 H active ("1400")	78	01111000
57	39	# 1 H blank ("288")	20	00100000
58	3A	# 1 H active : H blank ("1400 : 288")	51	01010001
59	3B	# 1 V active ("1050")	1A	00011010
60	3C	# 1 V blank ("16")	10	00010000
61	3D	# 1 V active : V blank ("1050 : 16")	40	01000000
62	3E	# 1 H sync offset ("48")	30	00110000
63	3F	# 1 H sync pulse width ("112")	70	01110000
64	40	# 1 V sync offset : V sync pulse width ("3 : 4")	34	00110100
65	41	# 1 H sync offset : H sync pulse width : V sync offset : V sync width ("48 : 112 : 3 : 4")	00	00000000
66	42	# 1 H image size ("304.5 mm")	30	00110000
67	43	# 1 V image size ("228.37 mm")	E4	11100100
68	44	# 1 H image size : V image size ("304 : 228")	10	00010000
69	45	# 1 H boarder ("0")	00	00000000
70	46	# 1 V boarder ("0")	00	00000000
71	47	# 1 Flags ("Non-Interlace, Non-Stereo, Digital Separate")	18	00011000
72	48	Detailed timing description # 2	00	00000000
73	49	# 2 Flag	00	00000000
74	4A	# 2 Reserved	00	00000000
75	4B	# 2 FE (hex) defines ASCII string (Model Name "N150P5", ASCII)	FE	11111110
76	4C	# 2 Flag	00	00000000
77	4D	# 2 1st character of string ("N")	4E	01001110
78	4E	# 2 2nd character of string ("1")	31	00110001
79	4F	# 2 3rd character of string ("5")	35	00110101
80	50	# 2 4th character of string ("0")	30	00110000
81	51	# 2 5th character of string ("P")	50	01010000
82	52	# 2 6th character of string ("5")	35	00111001
83	53	# 2 New line character # 2 indicates end of ASCII string	0A	00001010
84	54	# 2 Padding with "Blank" character	20	00100000
85	55	# 2 Padding with "Blank" character	20	00100000

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Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
42	2A	Standard timing ID # 3	01	00000001
43	2B	Standard timing ID # 3	01	00000001
44	2C	Standard timing ID # 4	01	00000001
45	2D	Standard timing ID # 4	01	00000001
46	2E	Standard timing ID # 5	01	00000001
47	2F	Standard timing ID # 5	01	00000001
48	30	Standard timing ID # 6	01	00000001
49	31	Standard timing ID # 6	01	00000001
50	32	Standard timing ID # 7	01	00000001
51	33	Standard timing ID # 7	01	00000001
52	34	Standard timing ID # 8	01	00000001
53	35	Standard timing ID # 8	01	00000001
54	36	Detailed timing description # 1 Pixel clock ("108 MHz")	30	00110000
55	37	# 1 Pixel clock (hex LSB first)	2A	00101010
56	38	# 1 H active ("1400")	78	01111000
57	39	# 1 H blank ("288")	20	00100000
58	3A	# 1 H active : H blank ("1400 : 288")	51	01010001
59	3B	# 1 V active ("1050")	1A	00011010
60	3C	# 1 V blank ("16")	10	00010000
61	3D	# 1 V active : V blank ("1050 : 16")	40	01000000
62	3E	# 1 H sync offset ("48")	30	00110000
63	3F	# 1 H sync pulse width ("112")	70	01110000
64	40	# 1 V sync offset : V sync pulse width ("3 : 4")	34	00110100
65	41	# 1 H sync offset : H sync pulse width : V sync offset : V sync width ("48 : 112 : 3 : 4")	00	00000000
66	42	# 1 H image size ("304.5 mm")	30	00110000
67	43	# 1 V image size ("228.37 mm")	E4	11100100
68	44	# 1 H image size : V image size ("304 : 228")	10	00010000
69	45	# 1 H boarder ("0")	00	00000000
70	46	# 1 V boarder ("0")	00	00000000
71	47	# 1 Flags ("Non-Interlace, Non-Stereo, Digital Separate")	18	00011000
72	48	Detailed timing description # 2	00	00000000
73	49	# 2 Flag	00	00000000
74	4A	# 2 Reserved	00	00000000
75	4B	# 2 FE (hex) defines ASCII string (Model Name "N150P5", ASCII)	FE	11111110
76	4C	# 2 Flag	00	00000000
77	4D	# 2 1st character of string ("N")	4E	01001110
78	4E	# 2 2nd character of string ("1")	31	00110001
79	4F	# 2 3rd character of string ("5")	35	00110101
80	50	# 2 4th character of string ("0")	30	00110000
81	51	# 2 5th character of string ("P")	50	01010000
82	52	# 2 6th character of string ("5")	35	00111001
83	53	# 2 New line character # 2 indicates end of ASCII string	0A	00001010
84	54	# 2 Padding with "Blank" character	20	00100000

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Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
85	55	# 2 Padding with "Blank" character	20	00100000
86	56	# 2 Padding with "Blank" character	20	00100000
87	57	# 2 Padding with "Blank" character	20	00100000
88	58	# 2 Padding with "Blank" character	20	00100000
89	59	# 2 Padding with "Blank" character	20	00100000
90	5A	Detailed timing description # 3	00	00000000
91	5B	# 3 Flag	00	00000000
92	5C	# 3 Reserved	00	00000000
93	5D	# 3 FE (hex) defines ASCII string (Vendor "CMO", ASCII)	FE	11111110
94	5E	# 3 Flag	00	00000000
95	5F	# 3 1st character of string ("C")	43	01000011
96	60	# 3 2nd character of string ("M")	4D	01001101
97	61	# 3 3rd character of string ("O")	4F	01001111
98	62	# 3 New line character # 3 indicates end of ASCII string	0A	00001010
99	63	# 3 Padding with "Blank" character	20	00100000
100	64	# 3 Padding with "Blank" character	20	00100000
101	65	# 3 Padding with "Blank" character	20	00100000
102	66	# 3 Padding with "Blank" character	20	00100000
103	67	# 3 Padding with "Blank" character	20	00100000
104	68	# 3 Padding with "Blank" character	20	00100000
105	69	# 3 Padding with "Blank" character	20	00100000
106	6A	# 3 Padding with "Blank" character	20	00100000
107	6B	# 3 Padding with "Blank" character	20	00100000
108	0A	Detailed timing description # 4	00	00000000
109	6D	# 4 Flag	00	00000000
110	6E	# 4 Reserved	00	00000000
111	6F	# 4 FC (hex) defines Monitor name ("Model Name "N150P5-L01", ASCII)	FC	11111100
112	70	# 4 Flag	00	00000000
113	71	# 4 1st character of name ("N")	4E	01001110
114	72	# 4 2nd character of name ("1")	31	00110001
115	73	# 4 3rd character of name ("5")	35	00110101
116	74	# 4 4th character of name ("0")	30	00110000
117	75	# 4 5th character of name ("P")	50	01010000
118	76	# 4 6th character of name ("5")	35	00111001
119	77	# 4 7th character of name ("-")	2D	00101101
120	78	# 4 8th character of name ("L")	4C	01001100
121	79	# 4 9th character of name ("0")	30	00110000
122	7A	# 4 9th character of name ("1")	31	00110001
123	7B	# 4 New line character # 4 indicates end of ASCII string	0A	00001010
124	7C	# 4 Padding with "Blank" character	20	00100000
125	7D	# 4 Padding with "Blank" character	20	00100000
126	7E	Extension flag	00	00000000
127	7F	Checksum	DE	11011110

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6. INTERFACE TIMING
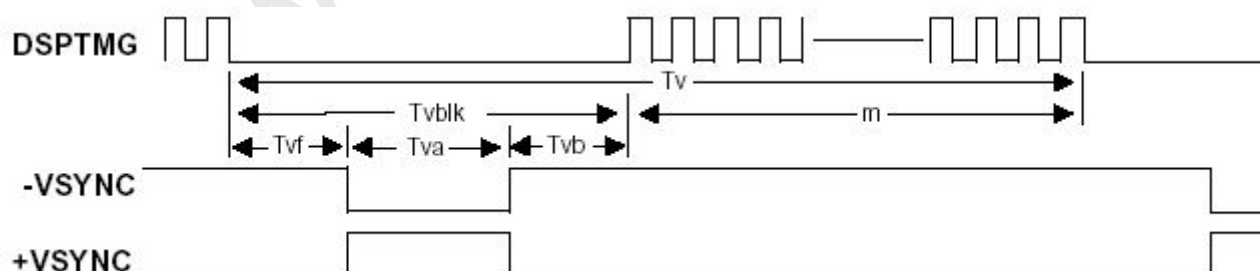
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	51	54	57	MHz	-
DE	Vertical Total Time	TV	1058	1066	2046	TH	-
	Vertical Addressing Time	TVD	1050	1050	1050	TH	-
	Horizontal Total Time	TH	762	844	1023	Tc	-
	Horizontal Addressing Time	THD	700	700	700	Tc	-

INPUT SIGNAL TIMING DIAGRAM (Horizontal Timing Chart)
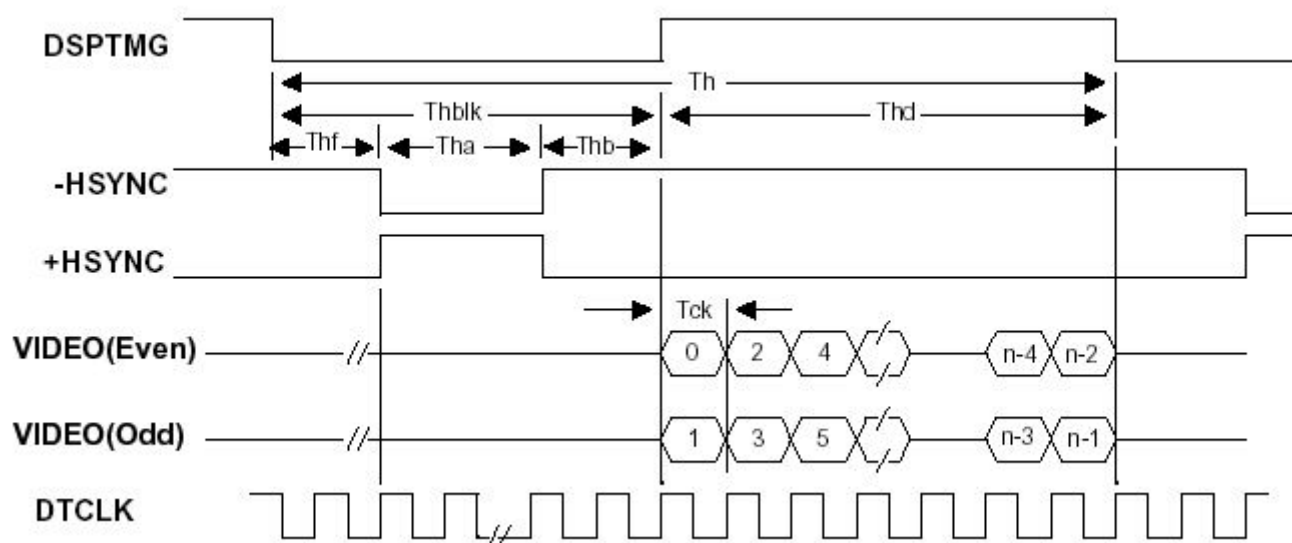
INPUT SIGNAL TIMING DIAGRAM (Vertical Timing Chart)

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6.2 POWER ON/OFF SEQUENCE
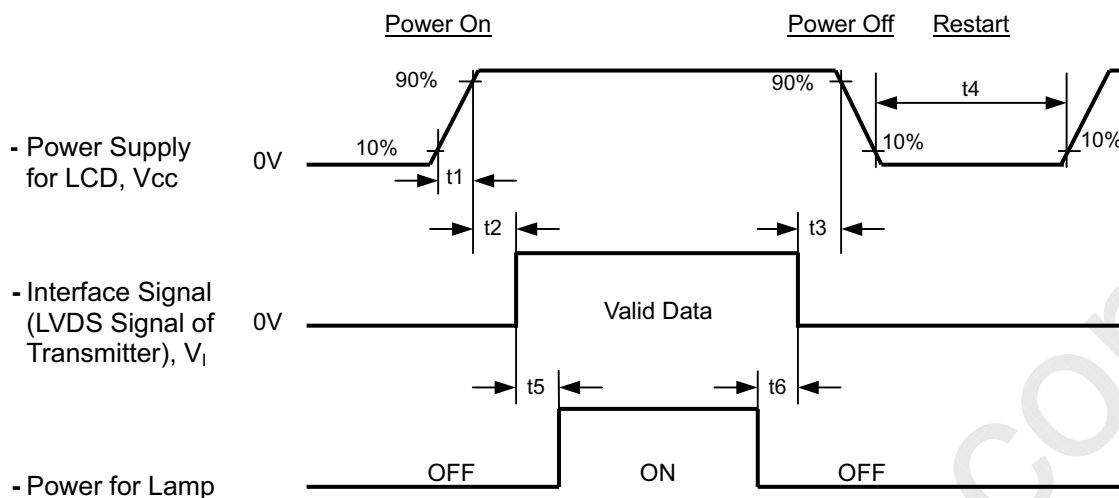
Timing Specifications:

$$470us \leqq t1 \leqq 10 \text{ msec}$$

$$0 < t2 \leqq 50 \text{ msec}$$

$$0 < t3 \leqq 50 \text{ msec}$$

$$t4 \geqq 500 \text{ msec}$$

$$t5 \geqq 200 \text{ msec}$$

$$t6 \geqq 200 \text{ msec}$$

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the Vcc falling time had better to follow $t7 \geqq 5 \text{ msec}$

6.3 Momentary Voltage Drops
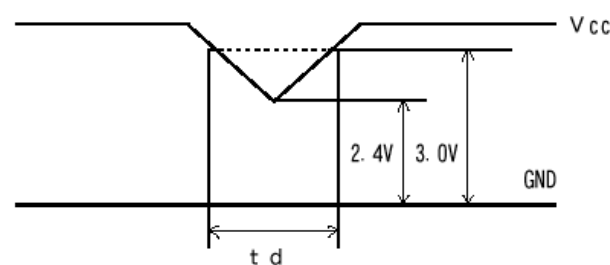
(1)   When $2.4V \leqq Vcc < 3.0V$ and $td \leqq 10ms$, the unit must work normally when VCC return to 3.0V.

(2)   When Vcc < 2.4V, momentary voltage shall conform to the input voltage sequence.

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7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	^{o}C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I_L	6.0	mA
Inverter Driving Frequency	F_L	55	KHz
Inverter	Sumida H05-4915		

The measurement methods of optical characteristics are shown in Section 7.2. The following items should be measured under the test conditions described in Section 7.1 and stable environment shown in Note (6).

7.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR		300	400	-	-	(2), (5)
Response Time		T_R		-	5	10	ms	(3)
		T_F		-	11	16	ms	
Average Luminance of White		L_{AVE}		170	200	-	cd/m^2	(4), (5)
White Variation of 5 Points		δW		-	-	1.25	-	(5), (6)
Color Chromaticity	Red	Rx	θ_x=0°, θ_Y=0° Viewing Normal Angle	Typ. -0.03	0.590	Typ. +0.03	-	(1), (5)
		Ry			0.340		-	
	Green	Gx			0.318		-	
		Gy			0.537		-	
	Blue	Bx			0.150		-	
		By			0.120		-	
	White	Wx			0.313		-	
		Wy			0.329		-	
Viewing Angle	Horizontal	θ_x+	CR≥10	50	60	-	Deg.	(1), (5)
		θ_x-		50	60	-		
	Vertical	θ_Y+		30	40	-		
		θ_Y-		50	60	-		

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Note (1)   Definition of Viewing Angle (θx, θy):
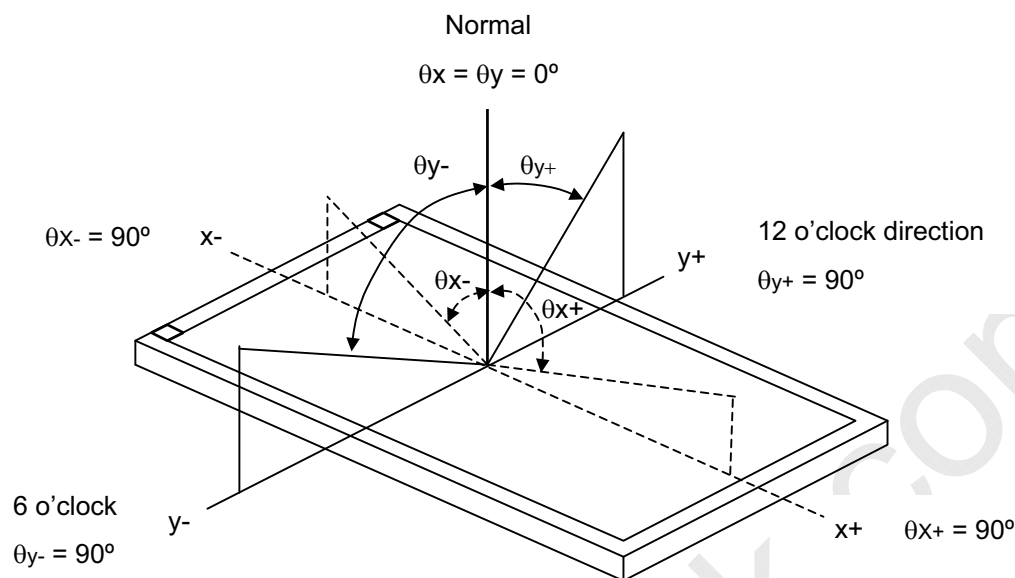
Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

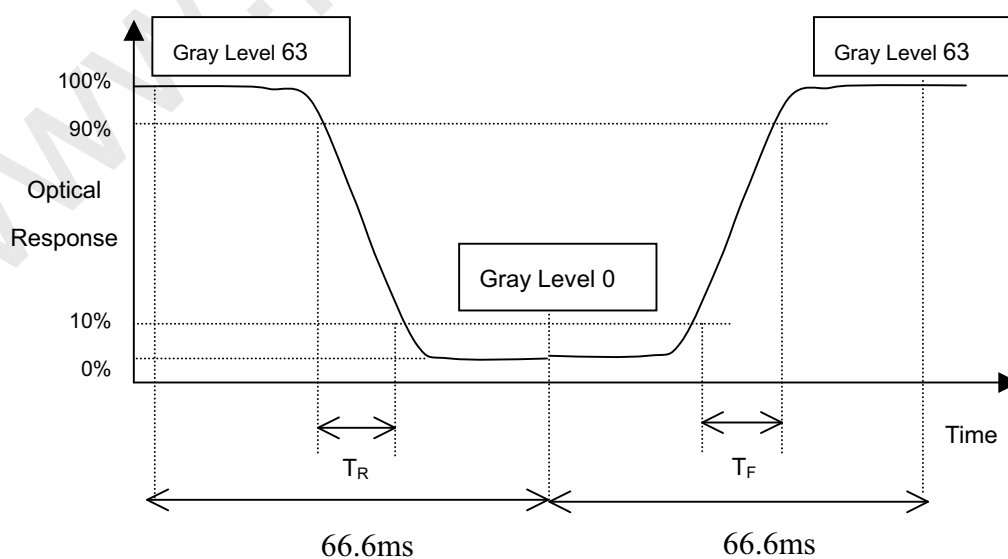L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (7).

Note (3) Definition of Response Time (T_R, T_F):

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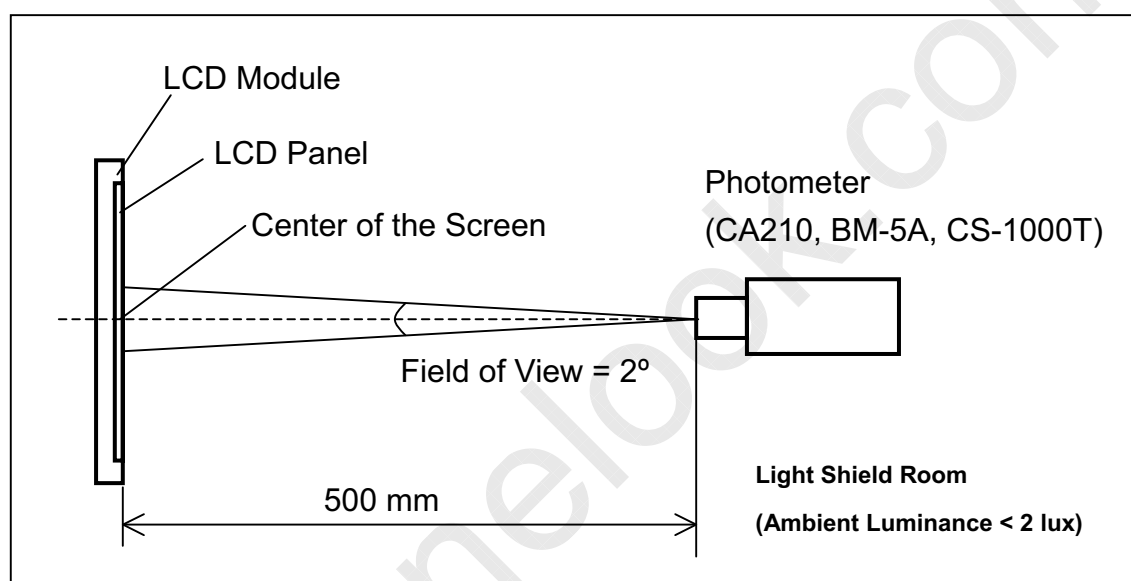Note (4) Definition of Average Luminance of White (L_{AVE}):

Measure the luminance of gray level 63 at 5 points

L_{AVE} = [L (1)+ L (2)+ L (3)+ L (4)+ L (5)] / 5

L (x) is corresponding to the luminance of the point X at Figure in Note (7).
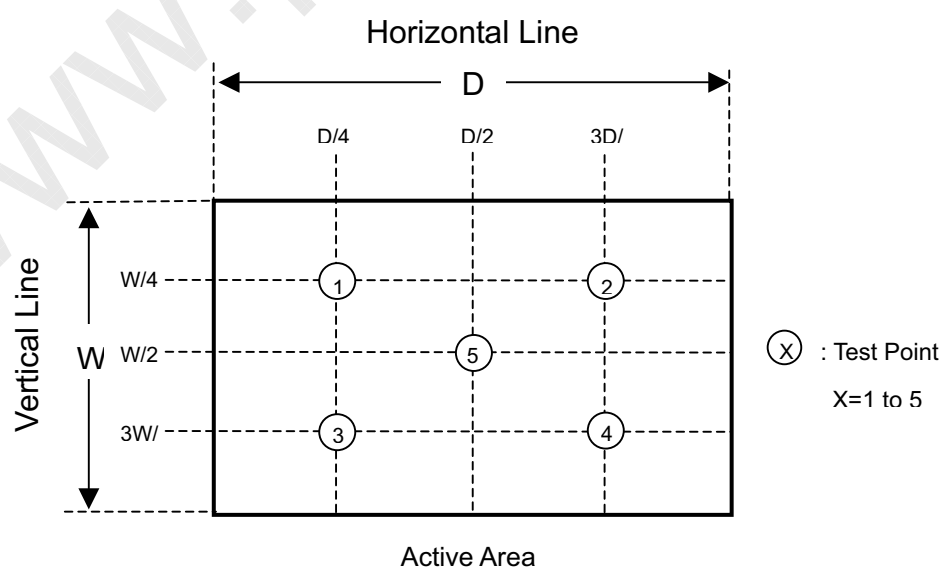
Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.

LCD Module

LCD Panel

Center of the Screen

Photometer
(CA210, BM-5A, CS-1000T)

Field of View = 2º

500 mm

Light Shield Room

(Ambient Luminance < 2 lux)

Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

δW = Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]

Horizontal Line

D

D/4   D/2   3D/

W/4   ①   ②

W   W/2   ⑤

3W/   ③   ④

Vertical Line

Active Area

Ⓧ : Test Point

X=1 to 5

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8. PRECAUTIONS

8.1 HANDLING PRECAUTIONS

(1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.

(2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.

(3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.

(4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.

(5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.

(6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.

(9) Do not disassemble the module.

(10) Do not pull or fold the lamp wire.

(11) Pins of I/F connector should not be touched directly with bare hands.

8.2 STORAGE PRECAUTIONS

(1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.

(3) It may reduce the display quality if the ambient temperature is lower than 10 ºC. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.
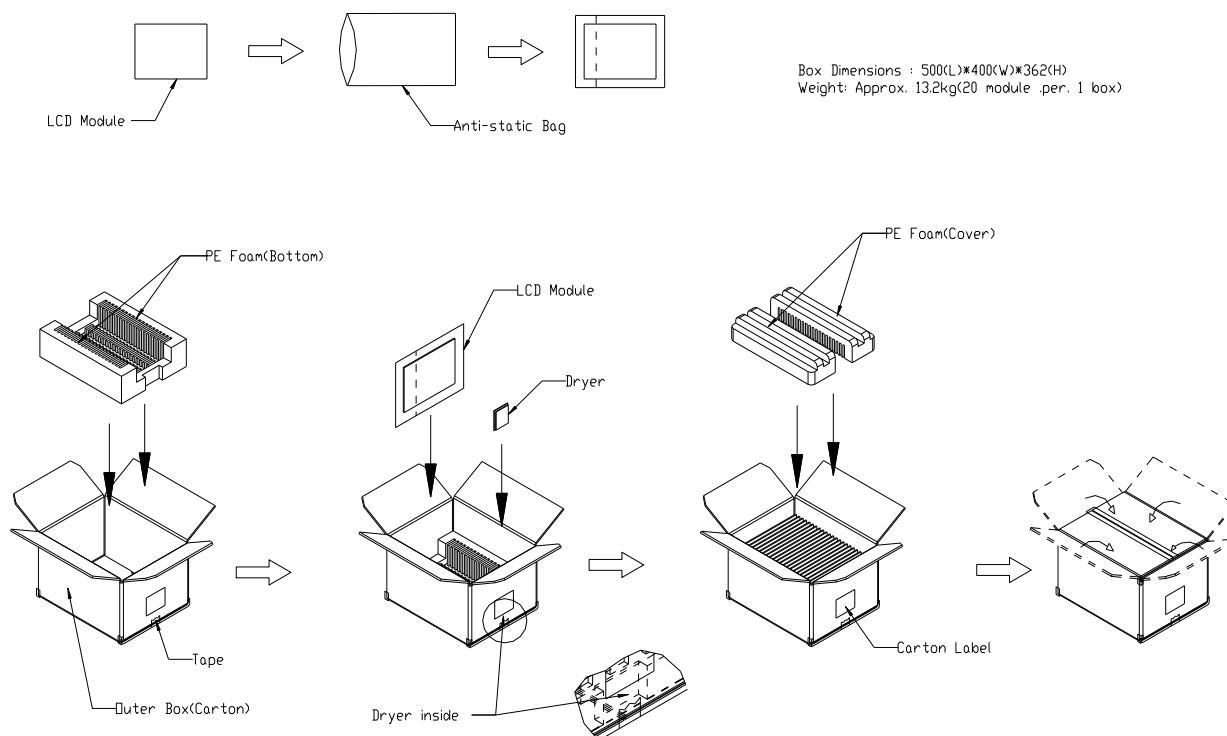
8.3 OPERATION PRECAUTIONS

(1) Do not pull the I/F connector in or out while the module is operating.

(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

(3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

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9. PACKING

9.1 CARTON

Box Dimensions : 500(L)*400(W)*362(H)
Weight: Approx. 13.2kg(20 module .per. 1 box)

9.2 PALLET

NOTES:
  Corner Protector:L1350mm*50mm*50mm
  Pallet:L1200*W1000*H135mm
  Pallet Stock Dim:L1200*W1000*H1593mm
  Weight:Approx.337kg

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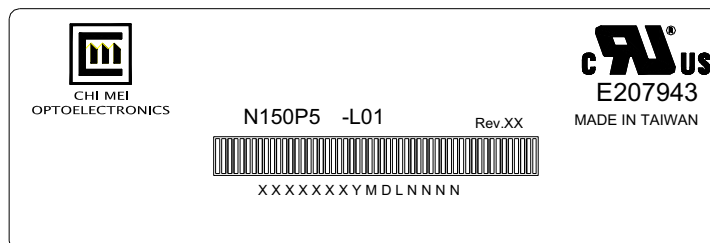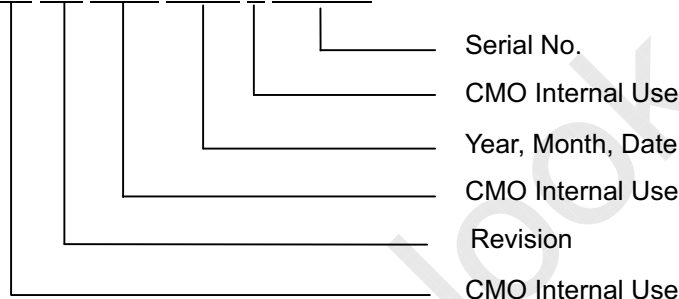**Approval**
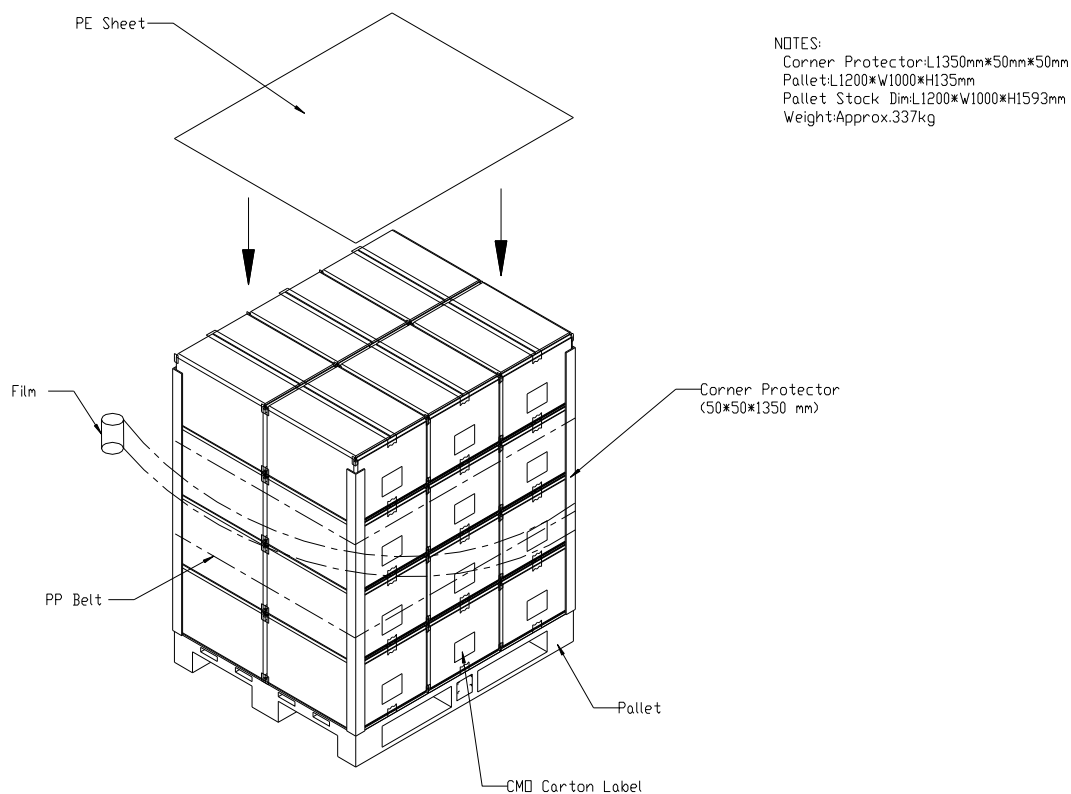
10. DEFINITION OF LABELS

10.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.
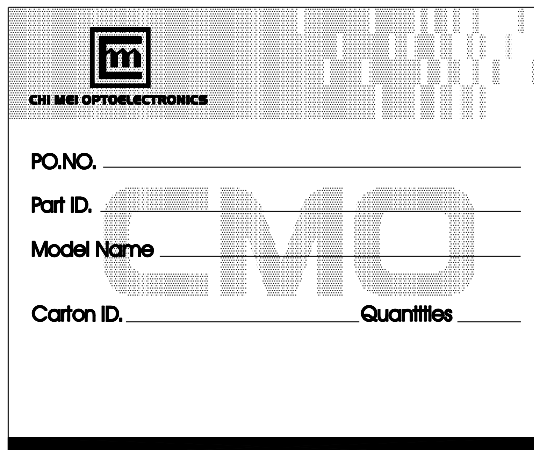
N150P5 -L01   Rev.XX

X X X X X X X Y M D L N N N N

E207943
MADE IN TAIWAN

(a) Model Name: N150P5 - L01

(b) Revision: Rev. XX, for example: A1, …, C1, C2 …etc.

(c) Serial ID: X X X X X X X Y M D X N N N N

    Serial No.

    CMO Internal Use

    Year, Month, Date

    CMO Internal Use

    Revision

    CMO Internal Use

Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2001~2009

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

10.2 CARTON LABEL

CHI MEI OPTOELECTRONICS

PO.NO. _____

Part ID. _____

Model Name _____

Carton ID. _____ Quantities _____

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Active Area 304.5X228.375

317.3 ±0.5
308.1 ±0.2 (Bezel Opening)
304.5 ±0.2 (Active Area)
1.8 ±0.5
1.8 ±0.5
1.8 ±0.5

(2X) 12.5±0.3
(8X) 3.1±0.3

(2X) 56.9±0.3
108.65 ±0.3
(2X) 160.4±0.3
159.35 ±0.3

(2X) 217.2±0.3
(2X) 229.5±0.5

228.375±0.2 (Active Area)
232±0.2 (Bezel Opening)
242±0.5

1.8 ±0.5

(8X) M2 SCREW HOLE
MAX 2.5mm DEPTH

45±0.5
11±1
105±5

USER_HOLE   USER_HOLE

5.7 +0.3/0

Don't Touch   Don't Touch   Don't Touch

Caution! Locking Connector

CONNECTOR JAE FI-XB30SL-HF10

134.4 ±0.5

30.5 ±0.5

N150P5-L01 Rev.XX

M$44N15120XX-L$XXXXXXXXXX

COLD CATHODE FLUORESCENT LAMP IN LCD PANEL CONTAINS A SMALL AMOUNT OF MERCURY. PLEASE FOLLOW LOCAL ORDINANCES OR REGULATIONS FOR DISPOSAL.

cRUus
E207943

2.5 (MAX)
1.2
MOLD FRAME
MINIMUM 3 THREADS, 2.5 KGF-CM
METAL FRAME

SECTION USER_HOLE-USER_HOLE
SCALE 10:1

CHI MEI OPTOELECTRONICS

cRUus
E207943
MADE IN TAIWAN

N150P5-L01   Rev.XX

XXXXXXXYMDXXXXX

NOTES:
1. GENERAL TOLERANCE: ±0.5mm MAX
2. SCREW TORQUE FOR MOUNTING SHOULD NOT EXCEED 2.5 KGF-CM

TITLE	OUTLINE DRAWING N150P5-L01		2D REV.	1
			3D REV.	
Approved	BILL SHEU	Drawing No.	N150941011	
Checked	YULE LIN	Part No.	TBD	
Drawer	CHI TSAI	Material	TBD	Sheet 1/1 A1
Designer	CHI TSAI	Date 01-Mar-2005	Scale 1:1 Unit:mm	

CHI MEI OPTOELECTRONICS CORP.

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| Mark | Description | Date | Changed_By | Approved_By | ECN No. | Remark |